Cellflow: a Parallel Application Development Environment with Run-Time Support for the Cell BE Processor

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INTRODUCTION

• Providing support for multimedia applications on MPSoC platforms remains a significant research challenge
• New tools for efficient mapping of applications onto hardware platforms
• We propose a novel mapping framework:
  • Programming
  • Automatic HW resource management
  • Allocation & Scheduling
  • Computation-efficient w.r.t. state-of-the-art commercial solvers

A multi-core system architecture
It addresses:
  - Server applications:
    • Next generation IBM Blade Servers.
  - High-performance embedded applications:
    • Gaming (Sony PS3).
    • Aerospace and defence.
    • Medical imaging.

Cell BE STI:
• Heterogeneous system:
  - 1 PPE
  - 8 SPEs
• Element Interconnect Bus: DMA-based
• Limited Local Storage
  - Only 256KB
• Explicit Resource management

Cellflow:
• A software development toolkit to help programmers in software implementation
• Starting from a high level task and data flow graph, software developers can easily and quickly build their application infrastructure.
• Programmers can intuitively translate high level representation into C-code using our facilities and libraries.
• The main goals are:
  - guarantees on high performance and constraint satisfaction;
  - predictable application execution after the optimization step.

FRAMEWORK

LOGIC-BASED BENDER DECOMPOSITION

FRAMEWORK

MULTI-STAGE DECOMPOSITION

EXPERIMENTAL RESULTS

TD vs pure-CP

Exact vs. Heuristic Scheduler:
• Heuristic:
  • RR resource allocation
  • List scheduling
  • Up to 40% makespan difference
  • 15% in average

TD vs BD

Validation of optimizer solutions:
• Comparison between optimizer prediction and real one
• Average difference: 4.8%
• Standard Deviation: 2.41

Radar Application:

Demonstrators: